



# National Transportation Safety Board Aviation Incident Final Report

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<b>Location:</b>	Rockville, VA	<b>Incident Number:</b>	NYC031A027
<b>Date &amp; Time:</b>	11/17/2002, 1800 EST	<b>Registration:</b>	N868CA
<b>Aircraft:</b>	Canadair CL-600-2B19	<b>Aircraft Damage:</b>	None
<b>Defining Event:</b>		<b>Injuries:</b>	51 None

**Flight Conducted Under:** Part 121: Air Carrier - Scheduled

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## Analysis

About 3 hours before takeoff, the dispatcher approved the flight release, which contained SIGMET Whiskey 8 for occasional severe turbulence from 14,000 feet to FL 280, and then went off duty. The turbulence box overlaid the departure airport and planned en route climb to altitude; however, the top of descent (TOD) and destination airport were clear of the turbulence. When the pilot printed the flight release, SIGMET Whiskey 8, had been replaced with SIGMET Whiskey 9. The turbulence box had moved east of the departure airport, and the TOD and destination airport remained clear of the turbulence box. The flight release also contained a single pilot report of severe turbulence from a Boeing 737 at FL 240, within the defined area of turbulence. Prior to departure, but after the flight release was signed by the pilot, the flight release was updated again, this time with SIGMET Whiskey 10. The turbulence box moved further east to cover the TOD and destination airport. Nearing his destination, the pilot was descended into the turbulence box defined by both SIGMET Whiskey 9 and Whiskey 10. These turbulence boxes ranged from Ottawa, Canada, to Florida, to Cleveland, Ohio. The pilot had turned on the seat belt sign, asked the flight attendant to be seated, and had already made an announcement for the passengers to remain seated as they were within 30 minutes of the destination airport. While descending through 17,800 feet, the flight encountered severe turbulence. The airplane was not equipped with ACARS. Flight crews were required to monitor dispatch frequency for updates, and encouraged to get weather updates en route. Weather updates were accomplished by direct radio contact between the dispatcher and pilots, or by the pilots accessing FAA facilities while en route. Although the operator had about 100 flights operating in the turbulence box, none were cancelled due to forecast turbulence, or reported to have encountered severe turbulence.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: The PIC's inadvertent encounter with turbulence while operating in an area of forecast occasional severe turbulence.

## Findings

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Occurrence #1: IN FLIGHT ENCOUNTER WITH WEATHER

Phase of Operation: DESCENT - NORMAL

### Findings

1. (C) WEATHER CONDITION - TURBULENCE,CLEAR AIR
2. FLIGHT INTO ADVERSE WEATHER - INADVERTENT - PILOT IN COMMAND

## Factual Information

### HISTORY OF FLIGHT

On November 17, 2002, about 1800 eastern standard time, a Bombardier CL-600-2B19 (CRJ-2), N868CA, operated by Comair as Delta Connection flight 5109 (Comair 109), encountered severe turbulence while in a descent near Rockville, Virginia. There were no injuries to the 2 certificated pilots, 1 flight attendant, or 48 passengers. Night instrument meteorological conditions prevailed for the flight that departed from The William B. Hartsfield, Atlanta International Airport (ATL), Atlanta, Georgia. The flight was destined for Ronald Reagan, Washington National Airport (DCA), Washington, DC. An instrument flight rules (IFR) flight plan had been filed for the scheduled, domestic, air carrier flight that was conducted under 14 CFR Part 121.

Prior to departure, the captain received and signed his flight release. The text above the space for the captain's signature stated:

"I HAVE REVIEWED THE DISPATCH RELEASE FOR THIS FLIGHT AND BASED ON THE INFORMATION FURNISHED BY AN AUTHORIZED AIRCRAFT DISPATCHER I BELIEVE THAT THE FLIGHT MAY BE MADE WITH SAFETY - 121.663 -"

Contained in the flight release were AIRMETS, a SIGMET for severe turbulence, and a pilot report of severe turbulence, all near or covering portions of the planned flight. SIGMET Whiskey 9 called for occasional severe turbulence between 13,000 feet and FL 280 (28,000 feet) due to wind shear associated with jet stream and middle/upper trough. The conditions were forecast to continue beyond 1820.

The passengers were boarded, and the airplane was out of the gate at 1620. The flight departed at 1702. The en route phase of the flight was conducted at FL 290 in visual meteorological conditions.

The cabin was prepared for arrival into Washington National Airport, and the seat belt sign had been illuminated. The flight attendant was advised to take her seat and remain seated.

The air/ground communications tape between airplanes operating on the frequencies, was reviewed. In addition, a partial transcript of pertinent air/ground communications between airplanes operating on the same frequency, and the controllers with Washington Air Traffic Control Center (ZDC) was prepared.

At 1748:21, Comair 109 reported that they were descending from FL 290 to FL 250.

At 1748:38, USA1404 reported that they were experiencing light chop at FL 280.

At 1748:42, while Comair was on the frequency, the controller told the USAir flight to expect continuous light and occasional moderate turbulence down to 12,000 feet. He also told the flight that he thought it was clear of any severe turbulence and had not heard of anything about severe turbulence lately.

At 1750:39, Comair 109 was instructed to descend and maintain FL 220.

At 1755:07, Comair 109 reported moderate turbulence.

At 1755:22, Comair 109 was instructed to descend to FL 190, and the pilots were advised they were going to be in "chop" down through 12,000 feet. After acknowledging the information,

Comair 109 was instructed to change frequencies to another sector.

At 1758:02, Comair 109 reported they were in moderate turbulence.

At 1758:26, Comair 109 was instructed to descend to 10,000 feet.

At 1759:53, Comair 109 reported an encounter with severe turbulence at 17,000 feet while on descent. The controller replied that this was the first severe turbulence report he had received in the last 40 minutes. Comair added that they encountered severe turbulence at 18,000 feet in the descent.

When queried about a minute later about that altitude range for the severe turbulence, the pilots of Comair 109 reported that they were still in steady moderate turbulence while descending through 15,500 feet, and the severe turbulence was between 20,000 feet and 18,000 feet.

The flight continued to Washington National Airport, landed at 1817, and arrived at the gate at 1825. The flight was met by emergency personnel. Several passengers were taken to area hospitals for observations; however, no injuries were reported.

According to the captain's written statement:

"...Before the encounter, only light with occasional moderate turbulence was experienced. The seatbelt sign was ON...[the first officer] had also warned the flight attendant to remain seated for her safety due to the turbulence."

"During the descent into DCA, at approximately flight level 190, in IMC conditions; we encountered extreme turbulence. The aircraft was at 280 knots, with Continuous Ignition ON, all anti-ice systems ON, and autopilot ON in turbulence mode."

"The aircraft encountered a positive gravitational acceleration followed by a negative and then a stronger positive gravitational acceleration. The extreme turbulence caused the autopilot to disengage, yaw damper to disengage, and the stall warning system to activate. I took manual control of the aircraft, returning it to a normal attitude and performance envelope. The encounter lasted approximately 5-7 seconds. The aircraft was undamaged and the flight continued safely to DCA."

According to the flight attendant's written statement:

"We were about 15 minutes out of DCA when we had some moderate turbulence. The...[captain] made a PA to tell us. Called and asked if everyone was ok. A few seconds later we had extremely severe turbulence that lasted 8 to 10 seconds. Rocking back and forth, up and down and dropping. I saw passengers hit their heads on the overhead bins and I had one passenger tossed out of his seat onto the floor....I yelled back "stay calm, stay on the floor, passengers around, hold him down." At that time there was no way I could get up or on the PA, I was being tossed around also side to side, I couldn't raise my arms from holding on. When I felt it was safe for him to move, I told him to hurry and get back into his seat. I then called the...[captain] and told him I had one passenger tossed out of his seat and landed on the floor. I asked him to have medical personnel to meet us in DCA. The aisles were full of things tossed around (purses, magazines, pillows, etc.)...."

When interviewed, both pilots reported that their flight bags were emptied and the contents tossed about the cockpit.

The captain further reported that he did not remember hearing other flights or the controller report any severe turbulence. He also reported that he was aware of the severe turbulence on the flight release and said that it covered the entire eastern seaboard. He said the dispatcher went over the weather with him, but did not mention any reports of severe turbulence.

The first officer further reported that he was not aware that the flight release contained a severe turbulence forecast.

After arrival in DCA, the airplane was given a visual inspection and released for a maintenance ferry flight to the Greater Cincinnati/Northern Kentucky International Airport (CVG), Covington, Kentucky.

The incident occurred during the hours of darkness, in instrument meteorological conditions (IMC), at 37 degrees, 43.5 minutes north latitude, and 77 degrees, 42.9 minutes west longitude, while the airplane was descending through 17,800 feet.

#### PERSONNEL INFORMATION

The captain held an airline transport pilot certificate with a multi-engine land rating, and a type rating for the CL-65. He held a commercial pilot certificate for single engine land airplanes, and a flight instructor rating for single and multi-engine airplanes and instrument airplane. He was last issued a FAA first class airman medical certificate on October 22, 2002. His last proficiency flight check was conducted on July 9, 2002. The captain reported his total flight experience as 4,500 hours, with 3,000 hours in make and model, and 230 hours in the preceding 90 days.

The first officer held a commercial pilot certificate with single and multi-engine land ratings, and an instrument airplane rating. He also held a flight instructor certificate with a single engine rating. He was last issued a FAA first class airman medical certificate on February 22, 2002. His last proficiency check was conducted on October 16, 2002. The first officer reported his total flight experience as 2,300 hours, with 650 hours in make and model, and 250 hours in the preceding 90 days.

The dispatcher held a dispatcher certificate. He had received training and became an assistant dispatcher in January 2000. He was upgraded to dispatcher in June 2000.

#### AIRCRAFT INFORMATION

The airplane was originally certificated by the Government of Canada, and in the United States through a bi-lateral agreement. The maximum allowable gross weight of the airplane was 53,000 pounds. The maximum allowable g loads were + 2.5 g, and -1.0 g.

According to the load manifest for the incident flight, the basic operating weight of the airplane was 31,123 pounds; the zero fuel weight was 40,623 pounds, and the takeoff gross weight was

49,073 pounds. The mean aerodynamic chord (MAC) was about 14 percent at takeoff, and 16 percent at the zero fuel weight.

The flight release projected a fuel burn of 3,661 pounds for the trip, and an elapsed time of 1 hour 11 minutes. The actual time en route was 1 hours 15 minutes.

#### METEOROLOGICAL INFORMATION

The flight release was reviewed by the dispatcher at 1338, who placed it in a queue, awaiting the pilot's call up. The dispatcher went off duty at 1430. The dispatcher reported that when he approved the flight release, it contained SIGMET Whiskey 8, which referenced an area of forecast severe turbulence, and he was aware of its contents.

Once a flight release was placed in the queue, it was not available for print from 10 minutes before the hour, until 5 minutes after the hour. This allowed the flight release to be automatically updated with the latest available weather.

When the pilot printed out the flight release, SIGMET Whiskey 8, had been replaced by SIGMET Whiskey 9, which referenced a different area of severe turbulence.

A review of SIGMETs Whiskey 8, 9, and 10 revealed the following.

SIGMET Whiskey 8 was issued at 1020 - The approximate geographic limits were from Tampa, Florida; Albany, Georgia; London, Kentucky; Cleveland, Ohio; Toronto, Canada; Ottawa, Canada; Plattsburgh, New York; Harrisburg, Pennsylvania; and Tampa, Florida. The SIGMET forecast occasional severe turbulence between 14,000 feet, and FL 280. This was the valid SIGMET when the flight release was approved by the dispatcher, but was not contained in the flight release signed by the pilot. The turbulence area overlaid Atlanta, and upon departure, the airplane would climb through the turbulence box. The eastern edge of the turbulence zone was west of the planned top of descent (TOD), destination airport, and the turbulence experienced by flight 109.

This was also the SIGMET that was active when the flight release for the preceding flight flown by the same pilots, Comair 5102 was prepared. The turbulence box was clear of the departure airport, Allentown, Pennsylvania, but overlaid the destination airport, Atlanta

SIGMET Whiskey 9 was issued at 1420 - The approximate geographic limits were Cape Coral, Florida; Tampa, Florida; Columbia, South Carolina; Cleveland, Ohio; Toronto, Canada; Ottawa, Canada; Plattsburgh, New York; Harrisburg, Pennsylvania; East of Wilmington, North Carolina; and Palm Beach, Florida. The SIGMET forecast occasional severe turbulence between 13,000 feet, and FL 280. This was the valid SIGMET when the pilot signed the flight release, but was not on the flight release approved by the dispatcher. The turbulence box had been shifted to the east. There was no turbulence overlay above Atlanta. The planned TOD and destination airport were east of the turbulence box. However, the area where the airplane encountered turbulence was within the confines of the turbulence box.

SIGMET Whiskey 10 was issued at 1520 - The approximate geographic limits were Cape Coral, Florida; Tampa, Florida; Columbia, South Carolina; Cleveland, Ohio; Toronto, Canada; Ottawa, Canada; Plattsburgh, New York; Cape May, New Jersey; East of Wilmington, North Carolina; and Palm Beach, Florida. The SIGMET forecast occasional severe turbulence between 10,000 feet, and FL 280. This was the valid SIGMET when the flight was en route to Washington, DC. It was released after the pilot received the flight release, and prior to the departure of flight 109. The turbulence box was east of Atlanta; however, it covered the eastern

seaboard, to the shore line. This included the TOD, destination airport, the location where the turbulence occurred, and the area of the pilot report of severe turbulence occurred.

A weather study was prepared by a Safety Board staff meteorologist. The study revealed that the turbulence occurred within an area of localized high vertical and horizontal wind shears, and high values of spectrum width, a measure of turbulence, from the Doppler weather radar.

The following definitions of turbulence were contained in the Aeronautical Information Manual (AIM).

Moderate Turbulence - "...changes in altitude an/or attitude occur, but the aircraft remains in positive control at all times...It causes rapid bumps or jolts...."

Severe Turbulence - "...large, abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control...."

Extreme Turbulence - "...the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage...."

Air traffic controllers are required to make a one-time announcement when SIGMETs, which cover their area of responsibility are released. However, there is no requirement for repetitive announcements. En route weather advisories were available to the pilots of Comair 109, through their dispatch system, and various FAA facilities.

#### Flight Release

A further review of the flight release for Comair 109 revealed it was 22 pages long.

Pages 1 through 3 1/3 contained the basic flight plan information and the fuel summary for the flight.

Pages 3 1/3 through 5 contained the computerized flight plan.

Pages 6 through 9 1/4 contained center weather advisories (CWAs). Several of the bulletins were duplicated. One bulletin was repeated 6 times.

Pages 9 1/4 through 17 1/4 contained AIRMETS and SIGMETs. Many were duplicated. SIGMET Whiskey 9 was repeated 9 times. Many of the items were outdated. The Arrangement placed AIRMETS before SIGMETs. AIRMETS included Sierra, Tango, and Zulu. Sierra AIRMETS are for mountain obscuration and instrument meteorological conditions, and are not applicable to instrument flight.

Pages 17 1/4 through 22 contained the departure, en route, destination, and alternate airport weather. Also included were NOTAMS. The NOTAMS that were listed under the destination airport included airports with runways as short as 2,500 feet, and no instrument approaches.

The investigation revealed that the weather used by the dispatcher to approve the flight, may not match the weather the pilot received when he printed out the flight release. There was nothing available to the pilot to assist him in determining what weather had been added, changed, or deleted from the flight release between the time the dispatcher approved the flight, and the pilot received his flight release.

The route in the computerized flight contained on the flight release, specified the latitude and longitude of specific points along the route of flight and the top of climb (TOC), and TOD. The TOD was located about 14 nm from the Richmond International Airport (RIC), Richmond

Virginia, on a magnet bearing of 020 degrees. The location of the severe turbulence encountered by Comair 109 was about 37 nm distant on a magnetic bearing of 310 degrees from the TOD.

The flight release also contained a pilot report of severe turbulence from a Boeing 737 at FL 240. The event occurred at 1430, and the airplane's location was 22 nm northwest of the turbulence experienced by Comair 109.

In interviews, both pilots reported that the flight release contained a lot of weather information. Further it was necessary to review a lot of non-pertinent data to arrive at the pertinent data.

## FLIGHT RECORDERS

The cockpit voice recorder had been written over and did not contain any information related to the incident. A transcript was not prepared.

The flight data recorder was initially read out by Comair, and subsequently forwarded to the Safety Board in Washington, DC.

According to the flight recorder data, the airplane was in a descent, passing through 17,800 feet, with a calibrated airspeed of about 296 knots, when the airspeed momentarily increased to 308 knots. The recorded vertical g load which had been about + 1.0, first decreased to - 0.031, then increased to +2.02, then decreased to -1.602, and then increased again to +3.367 g; over a period of about 3 seconds. The autopilot disconnected about the same time that the g load peaked at +3.367, and the airplane rolled 42 degrees to the left.

## ADDITIONAL INFORMATION

### Airplane Return to Service

The airplane manufacturer published procedures in the maintenance manual for return to service after a turbulence encounter. The captain had entered the following in the airplane logbook:

"At FL180 descending at approx 280 kts encountered extreme turbulence. Duration approx 5 seconds."

The discrepancy was cleared with the following entry:

"C/W part A of extreme turbulence inspection. No damage noted. A/C inspected and found safe for 1 time ferry flight to CVG per MC...[Maintenance Controller], for part B of extreme turbulence inspection and FDR download."

Upon arrival in CVG, the airplane was inspected in accordance with the extreme turbulence inspection. Part A was repeated, and the inspection continued with part B. The flight data recorder was downloaded, and a print made of the graphical display of the vertical acceleration, and other selected parameters as recorded. The print was forwarded to the airplane manufacturer. The airplane manufacturer replied:

"...Subject aircraft was reported to experience a negative 1.60 G and a positive 3.37 G after encountering severe turbulence during Flight 5109 from ATL to DCA, at FL 180 on descent approximately 280 knots."



"Upon review of the FDR data, as submitted by Comair Avionics Fax dated 18-Nov-02 (Ref. B), we recommend that the full inspection outlined the CRJ-200 Aircraft Maintenance Manual, chapter 05-51-03, 'Severe turbulence-Inspection Check' is accomplished with no finding. If any discrepancies are found, contact Bombardier Technical Help Desk for disposition...."

The airplane was returned to service on November 18, 2002, and entered revenue service again.

The task card for returning the airplane to service stated:

"...Before the task is started, it is necessary to find out how severe the turbulence, or in-flight maneuver was. This is done by an analysis of the related flight data."

"...The maintenance procedure that follows is for the download of the accelerometer reading from the digital flight-data recorder (FDR)...The downloaded data are then plotted on a graph and analyzed. As an alternative, a detailed report from the flight crew should be obtained. Based upon the graph analysis, or flight crew report, the following visual inspection of the aircraft be required...."

On page 609 of the Severe Turbulence Inspection, a severe turbulence load factors chart was found. The chart allowed for gross weight and vertical acceleration to be plotted. A diagonal line on the chart ran from 3 g, at 30,000 pounds to 2.2 g at 53,000 pounds. If the intersection of the gross weight and g load intersected above the line, the severe turbulence inspection was called for. If the gross weight and g load intersected below the line, no inspection was necessary. There was no chart for negative g values, nor was there any text in the Severe Turbulence Inspection that addressed negative g values.

#### Repeated Values - Flight Data Recorder

A further review of the flight recorder data revealed that the raw data values displayed by the flight data recorder for the vertical acceleration, and pitch attitude, contained repeated values. This led the Safety Board to recalculate the peak loads experienced by the airplane. The peak positive g of + 3.367 was revised to a value of + 4.4 g, and the peak negative g of - 1.602 g was revised to a value of - 2.0 g.

Based upon the revised g loads from the occurrence, the Safety Board suggested that additional inspections be given the airplane. The manufacturer, Bombardier developed additional inspection criteria for the airplane, and on December, 23, 2002, Comair removed the airplane from service. This was a more detailed inspection than had previously been conducted. It included draining the wings of fuel, opening up panels and checking for damage. In addition, additional inspections were made on the engine pylons and horizontal stabilizer. The inspection was completed on December 27, 2002, and the airplane was returned to service. No damage was found.

The repeating value problem was traced to the data concentrator unit (DCU) installed in the airplane. The primary purpose of the DCU was to support the EICAS displays. An additional function was to multiplex the data stream sent to the FDR.

According to 14 CFR Part 121, Appendix M, the flight data recorder was required to record vertical acceleration at 8 samples per second (8 Hz), and pitch attitude at 4 samples per second (4 Hz). The investigation revealed that while the recording rate to the FDR was met, the data was not updated with new or fresh data at the same rate.

The refresh rate for the vertical acceleration was 5 samples per second (5 Hz), which in any one second period resulted in 5 fresh data inputs and 3 stale or repeated data inputs. The refresh rate for the pitch attitude was 2 samples per second (2 Hz), which in any one second period resulted in 2 fresh inputs and 2 stale or repeated values.

A representative of Rockwell Collins, the manufacturer of the data collection unit reported that the design specification for the DCU specified the rate of data flow to the FDR, of 8 Hz for vertical acceleration, and 4 Hz for pitch attitude. However, there was no specification for the data refresh rate, and they elected to use a refresh rate of 5 Hz for vertical acceleration, and 2 Hz for pitch attitude.

Further, the representative of Rockwell Collins reported that the digital parameter of aircraft pitch attitude was supplied to the DCU by the ARINC 429 data bus at a rate of 50 Hz.

The error was not detected by Bombardier prior to certification. In addition, it was not detected by Transport Canada, when the airplane was certificated on July 31, 1992, or the FAA when they certified the airplane on January 21, 1993.

#### Flight 5102

The previous flight for the flight crew was flight 5102 (Comair 102). That flight originated from Allentown, Pennsylvania, and terminated in Atlanta. SIGMET Whiskey 8 was current for the flight. The turbulence box was west of the departure airport; however, it overlaid the en route portion of the flight, and the destination airport.

The first officer reported that the flight release for Comair 5109 contained very similar weather to their previous flight, Comair 5102. They had not encountered any problems on Comair 5102, and he did not see a problem with flight 5109 from Atlanta to Washington, DC.

#### Comair Operations Manual

The Comair Operations Manual, Section 2.26 Dispatcher contained the following:

"...[The dispatcher] monitors, updates, and transmits weather information to each Captain including airport conditions and irregularities of navigation facilities that may affect the safety of flight...."

The Comair Operations Manual, Section 6.5 Operational Control, contained the following:

"Operational control of Comair flights is a shared responsibility of the:

Director of Operation

Captain

Dispatcher"

"The function of these individuals regarding the operation of each flight is contained in the manual and other portions of the Comair Manual System."

"The Captain and the Dispatcher are jointly responsible for the pre-flight planning, delay, and Dispatch Release of a flight in compliance with this manual and Operations Specifications."

"The Captain of an aircraft is, during flight time, in command of the aircraft and crew and is responsible for the safety of the passengers, crewmembers, cargo and aircraft. Each Pilot-In-Command has full control and authority in the operations of the aircraft, without limitation, over other crewmembers and their duties during flight time."

"The Dispatcher is responsible for monitoring the progress of each flight; issuing necessary information for the safety of the flight; and canceling a flight if, in his opinion or the opinion of the Pilot-In-Command, the flight cannot operate or continue to operate safely as planned or released."

The Comair operations manual, Section 8.1 Flight Planning stated:

"Each aircraft operating under Part 121 regulations will be specifically dispatched (released) by a Federally Licensed Dispatcher. The Captain and the Dispatcher must agree that the flight can be conducted in accordance with the information on the Dispatch Release, the applicable FARs, and Comair policy and procedures."

"The Dispatcher will be thoroughly familiar with the reported and forecast weather conditions on the route to be flown. The Dispatcher will provide the Pilot-In-Command with this information, as well as any current reports or information on airport conditions or irregularities of navigation facilities and/or any weather phenomena that may affect the safety of flight."

The Captain will ensure that the flight is accurately planned and that all pertinent weather information is obtained and analyzed prior to flight. The Captain will consider Adverse Weather Conditions, Takeoff Weather, En Route Weather, Landing Weather, and any other information he deems appropriate. After Analyzing all available information, the captain must be satisfied that the flight can be completed safely."

The Comair operations manual, page 8-14 contained the following:

"...It is the Captain's responsibility to avoid areas of turbulence whenever possible. While a certain amount of flying must, by necessity, be conducted in turbulent air, the effects may be minimized by careful selection of the flight path and altitude."

- " Avoid flight in or near thunderstorms."
- " Avoid flight through cumulous clouds - deviate as necessary."
- " Avoid flight at lower altitudes, especially near mountain ranges."
- " Plan descent to minimize exposure to suspected low level turbulence"
- " Avoid flight into know or forecasted areas of severe or greater Clear Air Turbulence"

According to item 5.6 of the Operations Manual, Flight Deck/Cabin Communications And Coordination Procedures, included the following:

"...Prior to the flight, the Captain will ensure that all crewmembers are properly introduced and that the following items have been included in the crew briefing:"

- " Weather to be expected during flight...."

The pilots and dispatchers were asked about their interpretation of the operations manual, page 8-14, and the statement, "Avoid flight into known or forecast areas of severe or greater Clear Air Turbulence." The captain reported that the SIGMET covered a wide area, and he was not certain if the statement prohibited the flight. He also reported that he relied on pilot reports.

The dispatcher reported that the flight could be made safety because the descent would be

accomplished outside of the turbulence box (SIGMET Whiskey 8). When asked if he had been aware of SIGMET Whiskey 9 would he have approved the flight, the dispatcher reported that he would. When asked about turbulence avoidance, the dispatcher said that was the pilot's responsibility.

The airplane was not equipped with ACARS. Flight crews are required to monitor company dispatch frequencies for updates and changes. Updates and modifications were accomplished via radio contact between the dispatcher and pilots.

According to section 8.2 of the Operations Manual, Weather Services:

"Comair crews are encouraged to obtain updated weather information during flight"

The manual also listed various approved weather sources, including Comair System Operations Control; Flight Service Stations; National Weather Service; and commercial weather services.

From the time that the flight release for Comair 109 was first approved by the dispatcher, through the time of the turbulence encounter, Comair operated about a hundred flights that required departure climbs and/or descents through forecast areas of severe turbulence. None of the flights were cancelled due to forecast turbulence, and none of the other flights were reported to have encountered severe turbulence.

## Pilot Information

<b>Certificate:</b>	Airline Transport; Flight Instructor; Commercial	<b>Age:</b>	30, Male
<b>Airplane Rating(s):</b>	Multi-engine Land; Single-engine Land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	Seatbelt, Shoulder harness
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	Airplane Multi-engine; Airplane Single-engine; Instrument Airplane	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 1 Valid Medical--w/ waivers/lim.	<b>Last FAA Medical Exam:</b>	10/22/2002
<b>Occupational Pilot:</b>		<b>Last Flight Review or Equivalent:</b>	07/09/2002
<b>Flight Time:</b>	4500 hours (Total, all aircraft), 3000 hours (Total, this make and model), 3000 hours (Pilot In Command, all aircraft), 230 hours (Last 90 days, all aircraft)		

## Co-Pilot Information

<b>Certificate:</b>	Flight Instructor; Commercial	<b>Age:</b>	27, Male
<b>Airplane Rating(s):</b>	Multi-engine Land; Single-engine Land	<b>Seat Occupied:</b>	Right
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	Seatbelt, Shoulder harness
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	Airplane Single-engine	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 1 Valid Medical--w/ waivers/lim.	<b>Last FAA Medical Exam:</b>	02/21/2002
<b>Occupational Pilot:</b>		<b>Last Flight Review or Equivalent:</b>	10/16/2002
<b>Flight Time:</b>	2300 hours (Total, all aircraft), 650 hours (Total, this make and model), 1600 hours (Pilot In Command, all aircraft), 250 hours (Last 90 days, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Canadair	<b>Registration:</b>	N868CA
<b>Model/Series:</b>	CL-600-2B19	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>		<b>Amateur Built:</b>	No
<b>Airworthiness Certificate:</b>	Transport	<b>Serial Number:</b>	7427
<b>Landing Gear Type:</b>	Retractable - Tricycle	<b>Seats:</b>	54
<b>Date/Type of Last Inspection:</b>	10/06/2002, Continuous Airworthiness	<b>Certified Max Gross Wt.:</b>	53000 lbs
<b>Time Since Last Inspection:</b>	198.3 Hours	<b>Engines:</b>	2 Turbo Fan
<b>Airframe Total Time:</b>	5127.8 Hours at time of accident	<b>Engine Manufacturer:</b>	General Electric
<b>ELT:</b>	Installed, not activated	<b>Engine Model/Series:</b>	CF-34-3A1
<b>Registered Owner:</b>	Comair	<b>Rated Power:</b>	9220 lbs
<b>Operator:</b>	Comair	<b>Operating Certificate(s) Held:</b>	Flag carrier (121)
<b>Operator Does Business As:</b>	Delta Connection	<b>Operator Designator Code:</b>	COMA

## Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Night
Observation Facility, Elevation:	DCA, 15 ft msl	Distance from Accident Site:	75 Nautical Miles
Observation Time:	1756 EST	Direction from Accident Site:	35°
Lowest Cloud Condition:	Scattered / 2400 ft agl	Visibility	10 Miles
Lowest Ceiling:	Overcast / 3000 ft agl	Visibility (RVR):	
Wind Speed/Gusts:	/	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.68 inches Hg	Temperature/Dew Point:	7° C / 7° C
Precipitation and Obscuration:			
Departure Point:	Atlanta, GA (ATL)	Type of Flight Plan Filed:	IFR
Destination:	Washington, DC (DCA)	Type of Clearance:	IFR
Departure Time:	1702 EST	Type of Airspace:	Class C

## Airport Information

Airport:	Washington National Arpt (DCA)	Runway Surface Type:	Unknown
Airport Elevation:	15 ft	Runway Surface Condition:	Unknown
Runway Used:	NA	IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	None

## Wreckage and Impact Information

Crew Injuries:	3 None	Aircraft Damage:	None
Passenger Injuries:	48 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	51 None	Latitude, Longitude:	37.725000, -77.715000

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Robert L Hancock	<b>Report Date:</b>	06/02/2004
<b>Additional Participating Persons:</b>	Bob Drake; Federal Aviation Administration (AAI-100); Washington, DC Paul McClaskey; Comair; Cincinnati, OH Tony Lively; Bombardier Aerospace; Downsview, ONT, CD, Mark Clintsome; Transportation Safety Board of Canada; Ottawa, CD, Alan Dean; Herndon, VA		
<b>Publish Date:</b>			
<b>Investigation Docket:</b>	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at <a href="mailto:pubinq@ntsb.gov">pubinq@ntsb.gov</a> , or at 800-877-6799. Dockets released after this date are available at <a href="http://dms.nts.gov/pubdms/">http://dms.nts.gov/pubdms/</a> .		

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